AMENDMENTS TO THE CLAIMS:

1. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, an apparatus for designing a plurality of communication paths between said ingress node and said egress node, the apparatus comprising:

means for defining an objective function for minimizing a number of candidate tree graphs for accommodating said communication paths;

means for defining a first constraint equation for causing all of said candidate tree graphs to form a tree;

means for defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

means for defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate said communication paths; and

means for solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

2. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication

traffic of the network, an apparatus for designing a plurality of communication paths between said ingress node and said egress node, the apparatus comprising:

means for storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

means for defining an objective function for minimizing a number of candidate tree graphs for accommodating ones of said communication paths which cannot be accommodated in said existing tree;

means for defining a first constraint equation for causing all of said candidate tree graphs to form a tree if all of said communication paths cannot be accommodated in said existing tree;

means for defining a second constraint equation for accommodating said ones of communication paths in one of said candidate tree graphs;

means for defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate at least one of said communication paths; and

means for solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of communication paths can be accommodated.

3. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node communication traffic of the

network, an apparatus for designing a plurality of communication paths between said ingress node and said egress node, the apparatus comprising:

means for defining a first constraint equation for causing all candidate tree graphs to form a tree;

means for defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

means for embedding non-negative artificial variables into said first and second constraint equations;

means for defining an objective function for minimizing a total number of said non-negative artificial variables; and

means for solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

4. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, an apparatus for designing a plurality of communication paths between said ingress node and said egress node, the apparatus comprising:

means for storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

means for defining a first constraint equation for accommodating ones of said communication paths which cannot be accommodated in said existing tree in one of said candidate tree graphs;

means for defining a second constraint equation for causing all of said candidate tree graphs to form a tree;

means for embedding non-negative artificial variables into said first and second constraint equations;

means for defining an objective function for minimizing a total number of said non-negative artificial variables; and

means for solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of communication paths can be accommodated.

5. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a method of designing a plurality of communication paths between said ingress node and said egress node, the method comprising:

defining an objective function for minimizing a number of candidate tree graphs for accommodating said communication paths;

defining a first constraint equation for causing all of said candidate tree graphs to form a tree;

defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate said communication paths; and

solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

6. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a method of designing a plurality of communication paths between said ingress node and said egress node, the method comprising:

storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

defining an objective function for minimizing a number of candidate tree graphs for accommodating ones of said communication paths which cannot be accommodated in said existing tree;

defining a first constraint equation for causing all of said candidate tree graphs to form a tree if all of said communication paths cannot be accommodated in said existing tree;

defining a second constraint equation for accommodating said ones of communication paths in one of said candidate tree graphs;

defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate at least one of said communication paths; and

solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of said communication paths can be accommodated.

7. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a method of designing a plurality of communication paths between said ingress node and said egress node, the method comprising:

defining a first constraint equation for causing all candidate tree graphs to form a tree;

defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

embedding non-negative artificial variables into said first and second constraint equations;

defining an objective function for minimizing a total number of said non-negative artificial variables; and

solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

8. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a method of designing a plurality of communication paths between said ingress node and said egress node, the method comprising:

storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

defining a first constraint equation for accommodating ones of said communication paths which cannot be accommodated in said existing tree in one of said candidate tree graphs;

defining a second constraint equation for causing all of said candidate tree graphs to form a tree;

embedding non-negative artificial variables into said first and second constraint equations;

defining an objective function for minimizing a total number of said non-negative artificial variables; and

solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of communication paths can be accommodated.

9. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving

communication traffic of the network and said egress node delivering communication traffic of the network, a storage medium for storing an algorithm for operating a computer to design a plurality of communication paths between said ingress node and said egress node, said algorithm comprising:

defining an objective function for minimizing a number of candidate tree graphs for accommodating said communication paths;

defining a first constraint equation for causing all of said candidate tree graphs to form a tree;

defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate said communication paths; and

solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

10. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a storage medium for storing an algorithm for operating a computer to design a plurality of communication paths between said ingress node and said egress node, said algorithm comprising:

storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

defining an objective function for minimizing a number of candidate tree graphs for accommodating ones of said communication paths which cannot be accommodated in said existing tree;

defining a first constraint equation for causing all of said candidate tree graphs to form a tree if all of said communication paths cannot be accommodated in said existing tree;

defining a second constraint equation for accommodating said ones of communication paths in one of said candidate tree graphs;

defining a third constraint equation for determining whether each of said candidate tree graphs is used to accommodate at least one of said communication paths; and

solving a mathematical programming problem formed by said objective function, and said first, second and third constraint ~~constrain~~ equations to obtain a plurality of trees in which said communication paths can be accommodated.

11. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a storage medium for storing an algorithm for operating a computer to design a plurality of communication paths between said ingress node and said egress node, said algorithm comprising:

defining a first constraint equation for causing all candidate tree graphs to form a tree;

defining a second constraint equation for accommodating said communication paths in one of said candidate tree graphs;

embedding non-negative artificial variables into said first and second constraint equations;

defining an objective function for minimizing a total number of said non-negative artificial variables; and

solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of said communication paths can be accommodated.

12. (Currently amended) In a communication network comprising an ingress node, a plurality of core nodes connected by links to the ingress node, and an egress node connected by links to the ingress node via the core nodes, said ingress node receiving communication traffic of the network and said egress node delivering communication traffic of the network, a storage medium for storing an algorithm for operating a computer to design a plurality of communication paths between said ingress node and said egress node, said algorithm comprising:

storing an existing tree and determining whether said communication paths can be accommodated in said existing tree;

defining a first constraint equation for accommodating ones of said communication paths which cannot be accommodated in said existing tree in one of said candidate tree graphs;

defining a second constraint equation for causing all of said candidate tree graphs to form a tree;

embedding non-negative artificial variables into said first and second constraint equations;

defining an objective function for minimizing a total number of said non-negative artificial variables; and

solving a mathematical programming problem formed by said objective function, and said first and second constraint ~~constrain~~ equations to obtain a plurality of trees in which said ones of communication paths can be accommodated.